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Abstract

WORK IN THE UNITED KINGDOM ON FIXATION OF HIGHLY RADIOACTIVE WASTES IN GLASS

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The paper describes the present state of development of a process for the conversion of radioactive waste liquors from a plant processing civil reactor fuel to a glassy solid suitable for long term storage. Glasses based on the borosilicate system fulfil the requirements for the Harwell process but phosphate glasses appear to offer some important advantages. The pilot plant experiments to date have been conducted with borosilicate glass. The results of sixteen runs on the active pilot plant, FINGAL, are discussed. Decontamination factors from feed to condensate of 10^8 are achieved for isotopes such as ^{90}Sr and ^{137}Cs. The same decontamination factor is also achieved for long periods for Ruthenium, but ultimate breakthrough lowers the overall value for Ru to 10^5. Ruthenium trapped on a filter is not volatilized again when the filter is incorporated in the glass of a subsequent cycle. Only one part in 10^{13} of the total activity was detected in the exhaust gas from the process when 1,000 curies of mixed fission products were vitrified during 42 hours operation.

The industrial application of the FINGAL process is considered for the fixation of the highly active waste arising from a 6,000 MW magnox reactor power programme involving 2,000 tonnes of uranium per year. The number of disposable cylinders required, the number of fixation units required, and the method of storage are assessed for various possible operating conditions.

Data show how rates of conversion of liquid to glass and temperatures generated in storage vary with size of disposable process vessel. It is

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concluded that liquid wastes should be stored for two years and then solidified in vessels twelve inches in diameter. Estimates have shown that the process costs are comparable with those for storage of highly concentrated liquid in tanks. These costs represent less than 1% of the value of electricity generated from the fuel.